

**WHAT IS CLAIMED IS:**

1. A photoprotective composition comprising at least one aqueous phase, at least one oily phase, at least one partially or completely neutralized, crosslinked or non-crosslinked water-soluble or water-dispersible acrylamido-2-methylpropanesulfonic acid (AMPS) polymer and at least one UV radiation-screening system, said at least one screening system comprising at least one 4,4-diarylbutadiene UV-A-screening agent.
2. The photoprotective composition as defined by Claim 1, said at least one AMPS polymer being partially or completely neutralized with an inorganic or organic base.
3. The photoprotective composition as defined by Claim 2, such neutralization being with sodium hydroxide, potassium hydroxide or aqueous ammonia.
4. The photoprotective composition as defined by Claim 2, such neutralization being with mono-, di- or triethanolamine, aminomethylpropanediol, N-methylglucamine, basic amino acids and mixtures thereof.
5. The photoprotective composition as defined by Claim 1, said at least one AMPS polymer being at least 90% neutralized.
6. The photoprotective composition as defined by Claim 1, said at least one AMPS polymer being crosslinked with a crosslinking agent selected from among olefinically polyunsaturated compounds.

7. The photoprotective composition as defined by Claim 6, said crosslinking agent being selected from among divinylbenzene, diallyl ether, dipropylene glycol diallyl ether, polyglycol diallyl ethers, triethylene glycol divinyl ether, hydroquinone diallyl ether, ethylene glycol or tetraethylene glycol di(meth)acrylate, trimethylolpropane triacrylate, methylenebisacrylamide, methylenebismethacrylamide, triallylamine, triallyl cyanurate, diallyl maleate, tetraallylethylenediamine, tetraallyloxyethane, trimethylolpropane diallyl ether, allyl (meth)acrylate, allyl ethers of alcohols of the sugar series, or other allyl or vinyl ethers of polyfunctional alcohols, and the allyl esters of phosphoric and/or vinylphosphonic acid derivatives, or mixtures thereof.

8. The photoprotective composition as defined by Claim 6, said crosslinking agent comprising methylenebisacrylamide, allyl methacrylate or trimethylolpropane triacrylate (TMPTA).

9. The photoprotective composition as defined by Claim 1, the degree of crosslinking ranging from 0.01 to 10 mol% relative to the polymer.

10. The photoprotective composition as defined by Claim 1, said at least one AMPS polymer being water-soluble or water-dispersible and selected from the group consisting of:

- (i) crosslinked or non-crosslinked AMPS homopolymers;
- (ii) crosslinked or non-crosslinked copolymers obtained from AMPS and from one or more hydrophilic ethylenically unsaturated monomers or hydrophobic ethylenically unsaturated monomers containing no fatty chain.

11. The photoprotective composition as defined by Claim 10, said water-dispersible AMPS polymers having a molar mass ranging from 50,000 g/mol to 10,000,000 g/mol.
12. The photoprotective composition as defined by Claim 10, the AMPS homopolymer comprising ammonium polyacryloyldimethyltauramide.
13. The photoprotective composition as defined by Claim 10, the crosslinked or non-crosslinked copolymers of AMPS and of one or more hydrophilic or hydrophobic ethylenically unsaturated monomers being selected from among:
  - (a) copolymers of AMPS and acrylamide or methylacrylamide;
  - (b) copolymers of AMPS and vinylpyrrolidone or vinylformamide.
14. The photoprotective composition as defined by Claim 13, the water-dispersible copolymer of AMPS being selected from among:

polyacrylamide/C<sub>13</sub>-C<sub>14</sub> isoparaffin/laureth-7;

acrylamide/sodium acryloyldimethyltaurate/isohehexadecane/polysorbate-80;

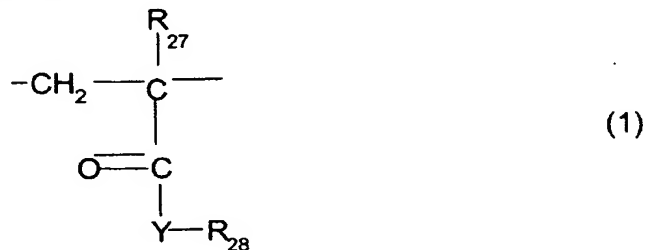
ammonium acryloyldimethyltaurate/VP copolymer.
15. The photoprotective composition as defined by Claim 1, said at least one AMPS polymer being amphiphilic.
16. The photoprotective composition as defined by Claim 15, said amphiphilic AMPS polymer comprising at least one fatty chain containing from 7 to 30 carbon atoms.

17. The photoprotective composition as defined by Claim 15, said amphiphilic AMPS polymer having a weight-average molecular weight ranging from 50,000 to 10,000,000.

18. The photoprotective composition as defined by Claim 15, said amphiphilic AMPS polymer comprising a random amphiphilic AMPS polymer modified by reaction with a C<sub>6</sub>-C<sub>22</sub> n-monoalkylamine or di-n-alkylamine and optionally containing one or more ethylenically unsaturated hydrophilic monomers.

19. The photoprotective composition as defined by Claim 15, said amphiphilic AMPS polymer being selected from among AMPS polymers from at least one ethylenically unsaturated monomer containing at least one hydrophobic part having from 7 to 30 carbon atoms and optionally one or more ethylenically unsaturated hydrophilic comonomers.

20. The photoprotective composition as defined by Claim 19, said ethylenically unsaturated monomers containing at least one hydrophobic part having from 7 to 30 carbon atoms being selected from among acrylates and acrylamides of the following formula (1):



in which R<sub>27</sub> is a hydrogen atom, a linear or branched C<sub>1</sub>-C<sub>6</sub> alkyl radical; Y is O or NH; and R<sub>28</sub> is a hydrophobic radical containing a fatty chain having from 7 to 22 carbon atoms.

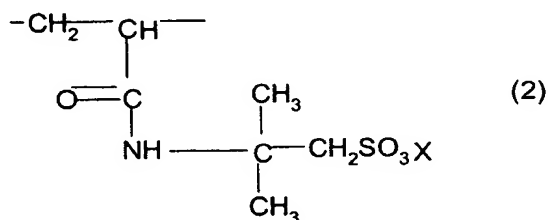
21. The photoprotective composition as defined by Claim 20, wherein formula (1), the hydrophobic radical  $R_{28}$  is a saturated or unsaturated, linear or branched  $C_7$ - $C_{18}$  alkyl radical,  $C_7$ - $C_{18}$  perfluorinated alkyl radical, the cholesteryl radical or a cholesterol ester, or an aromatic polycyclic radical.

22. The photoprotective composition as defined by Claim 20, wherein formula (1), the hydrophobic radical  $R_{28}$  further contains at least one alkylene oxide structural unit.

23. The photoprotective composition as defined by Claim 22, the number of moles of oxyalkylenated structural units ranging from 1 to 30 mol.

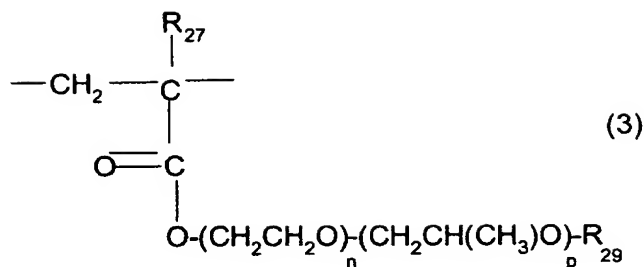
24. The photoprotective composition as defined by Claim 20, the amphiphilic AMPS polymers comprising amphiphilic copolymers of:

(a) 2-acrylamido-2-methylpropanesulfonic acid (AMPS) structural units of the following formula (2):



in which  $X^+$  is a proton, an alkali metal cation, an alkaline earth metal cation or the ammonium ion; and

(b) structural units of the following formula (3):



in which  $\underline{n}$  and  $\underline{p}$ , independently of each other, are each a number of moles and varies from 0 to 30, provided that  $\underline{n} + \underline{p}$  is less than or equal to 30;  $\text{R}_{27}$  has the same meaning indicated above in formula (1) and  $\text{R}_{29}$  is a linear or branched alkyl containing  $\underline{m}$  carbon atoms ranging from 7 to 22.

25. The photoprotective composition as defined by Claim 24, wherein formula (2),  $\text{X}^+$  is sodium or ammonium.

26. The photoprotective composition as defined by Claim 24, said amphiphilic AMPS polymers comprising:

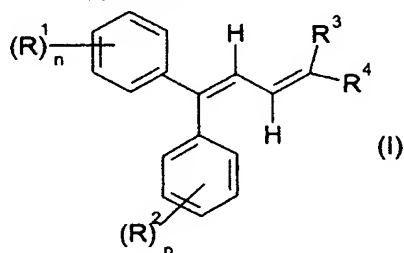
- (i) those which are non-crosslinked, in which  $\underline{p}=0$ ,  $\underline{n}=7$  or 25,  $\text{R}_{27}$  is methyl and  $\text{R}_{29}$  is a mixture of  $\text{C}_{12}\text{-C}_{14}$  or  $\text{C}_{16}\text{-C}_{18}$  alkyl, or
- (ii) those which are crosslinked, in which  $\underline{p}=0$ ,  $\underline{n}=8$  or 25,  $\text{R}_{27}$  is methyl and  $\text{R}_{29}$  is a mixture of  $\text{C}_{16}\text{-C}_{18}$  alkyl.

27. The photoprotective composition as defined by Claim 24, wherein the molar proportion of structural units of formula (3) ranges from 0.1 to 50%.

28. The photoprotective composition as defined by Claim 24, wherein the molar proportion of structural units of formula (3) ranges from 50.1% to 99.9%.

29. The photoprotective composition as defined by Claim 1, said at least one AMPS polymer comprising from 0.01 % to 20% by weight relative to the total weight of the composition.

30. The photoprotective composition as defined by Claim 1, said at least one 4,4-diarylbutadiene UV-A-screening agent having the following formula (I):



in which the diene system is of the Z,Z; Z,E; E,Z or E,E configuration or mixture of said configurations, and wherein:

$R^1$  and  $R^2$ , which may be identical or different, are each hydrogen, a  $C_1$ - $C_{20}$  alkyl radical, a  $C_2$ - $C_{10}$  alkenyl radical, a  $C_1$ - $C_{12}$  alkoxy radical, a  $C_3$ - $C_{10}$  cycloalkyl radical, a  $C_3$ - $C_{10}$  cycloalkenyl radical, a  $C_1$ - $C_{20}$  alkoxycarbonyl radical, a  $C_1$ - $C_{12}$  monoalkylamino radical, a  $C_1$ - $C_{12}$  dialkylamino radical, an aryl radical, a heteroaryl radical or a water-solubilizing substituent selected from among a carboxylate residue, a sulfonate residue or an ammonium residue;

$R^3$  is a group  $COOR^5$ ,  $COR^5$ ,  $CONR^5R^6$ ,  $CN$ ,  $O=S(-R^5)=O$ ,  $O=S(-OR^5)=O$ ,  $R^7O-P(-OR^8)=O$ , a  $C_1$ - $C_{20}$  alkyl radical, a  $C_2$ - $C_{10}$  alkenyl radical, a  $C_3$ - $C_{10}$  cycloalkyl radical, a  $C_7$ - $C_{10}$  bicycloalkyl radical, a  $C_3$ - $C_{10}$  cycloalkenyl radical, a  $C_7$ - $C_{10}$  bicycloalkenyl radical, an optionally substituted  $C_6$ - $C_{18}$  aryl radical an optionally substituted  $C_3$ - $C_7$  heteroaryl radical;

$R^4$  is a group  $COOR^6$ ,  $COR^6$ ,  $CONR^5R^6$ ,  $CN$ ,  $O=S(-R^6)=O$ ,  $O=S(-OR^6)=O$ ,  $R^7O-P(-OR^8)=O$ , a  $C_1$ - $C_{20}$  alkyl radical, a  $C_2$ - $C_{10}$  alkenyl radical, a  $C_3$ - $C_{10}$  cycloalkyl radical, a  $C_7$ - $C_{10}$  bicycloalkyl radical, a  $C_3$ - $C_{10}$  cycloalkenyl radical, a

C<sub>7</sub>-C<sub>10</sub> bicycloalkenyl radical, an optionally substituted C<sub>6</sub>-C<sub>18</sub> aryl radical, an optionally substituted C<sub>3</sub>-C<sub>7</sub> heteroaryl radical;

the radicals R<sup>5</sup> to R<sup>8</sup>, which may be identical or different, are each hydrogen, a C<sub>1</sub>-C<sub>20</sub> alkyl radical, a C<sub>2</sub>-C<sub>10</sub> alkenyl radical, a C<sub>3</sub>-C<sub>10</sub> cycloalkyl radical, a C<sub>7</sub>-C<sub>10</sub> bicycloalkyl radical, a C<sub>3</sub>-C<sub>10</sub> bicycloalkenyl radical, a C<sub>7</sub>-C<sub>10</sub> cycloalkenyl radical, an optionally substituted aryl radical, an optionally substituted heteroaryl radical; and

n ranges from 1 to 3; with the proviso that the radicals R<sup>3</sup> to R<sup>8</sup> can together form, with the carbon atoms from which they depend, a C<sub>5</sub>-C<sub>6</sub> ring which may be fused.

31. The photoprotective composition as defined by Claim 30, wherein formula (I):

n = 1 or 2;

R<sup>1</sup> and R<sup>2</sup>, which may be identical or different, are each hydrogen, a C<sub>1</sub>-C<sub>20</sub> alkyl radical, a C<sub>1</sub>-C<sub>12</sub> alkoxy radical, a C<sub>1</sub>-C<sub>12</sub> monoalkylamino radical, a C<sub>1</sub>-C<sub>12</sub> dialkylamino radical, a water-solubilizing substituent selected from among a carboxylate group, a sulfonate group or an ammonium residue;

R<sup>3</sup> is a group COOR<sup>5</sup>, COR<sup>5</sup>, CONR<sup>5</sup>R<sup>6</sup>, a C<sub>1</sub>-C<sub>20</sub> alkyl radical, a C<sub>3</sub>-C<sub>10</sub> cycloalkyl radical, a C<sub>3</sub>-C<sub>10</sub> cycloalkenyl radical, a C<sub>7</sub>-C<sub>10</sub> bicycloalkyl radical, optionally substituted phenyl, naphthyl or thienyl;

R<sup>4</sup> is a group COOR<sup>6</sup>, COR<sup>6</sup>, CONR<sup>5</sup>R<sup>6</sup>, a C<sub>1</sub>-C<sub>20</sub> alkyl radical, a C<sub>3</sub>-C<sub>6</sub> cycloalkyl radical, a C<sub>3</sub>-C<sub>10</sub> cycloalkenyl radical, a C<sub>7</sub>-C<sub>10</sub> bicycloalkyl radical, optionally substituted phenyl, naphthyl or thienyl; and

the radicals R<sup>5</sup> and R<sup>6</sup>, which may be identical or different, are each hydrogen, a C<sub>1</sub>-C<sub>12</sub> alkyl radical, a C<sub>3</sub>-C<sub>10</sub> cycloalkyl radical, a C<sub>3</sub>-C<sub>10</sub> cycloalkenyl radical, a C<sub>7</sub>-C<sub>10</sub> bicycloalkyl radical, a C<sub>3</sub>-C<sub>10</sub> bicycloalkenyl radical, optionally substituted phenyl or naphthyl.



32. The photoprotective composition as defined by Claim 31, wherein formula (I):

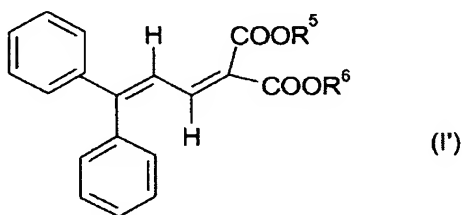
$R^1$  and  $R^2$ , which may be identical or different, are each hydrogen, a  $C_1$ - $C_{20}$  alkyl radical, a  $C_1$ - $C_{20}$  alkoxy radical, a water-solubilizing substituent selected from among a carboxylate group, a sulfonate group or an ammonium residue;

$R^3$  is a group  $COOR^5$ ,  $COR^5$ ,  $CONR^5R^6$ ;

$R^4$  is a group  $COOR^6$ ,  $COR^6$ ,  $CONR^5R^6$ ; and

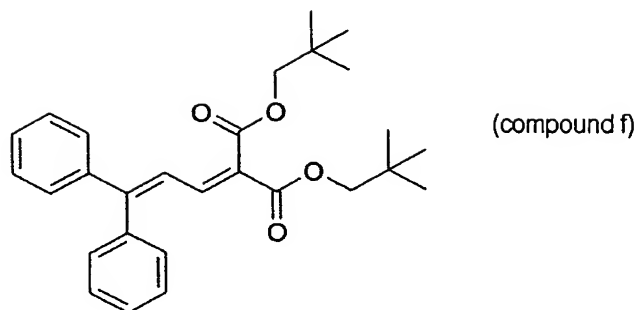
the radicals  $R^5$  and  $R^6$ , which may be identical or different, are each hydrogen, a  $C_1$ - $C_{12}$  alkyl radical, a  $C_3$ - $C_6$  cycloalkyl radical, a  $C_3$ - $C_{10}$  cycloalkenyl radical, a  $C_7$ - $C_{10}$  bicycloalkyl radical, a  $C_3$ - $C_{10}$  bicycloalkenyl radical, optionally substituted phenyl or naphthyl.

33. The photoprotective composition as defined by Claim 32, the compound of formula (I) having the following formula (I'):

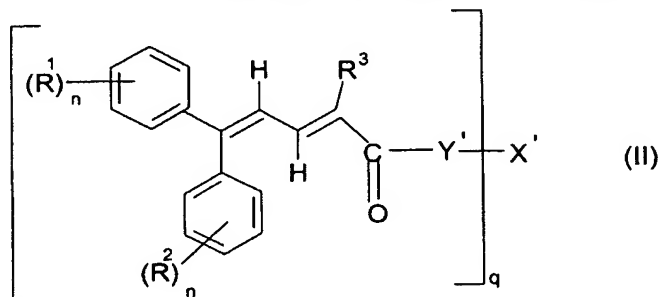


wherein the radicals  $R^5$  and  $R^6$ , which may be identical or different, are each hydrogen, a  $C_1$ - $C_{20}$  alkyl radical, a  $C_3$ - $C_6$  cycloalkyl radical, a  $C_3$ - $C_{10}$  cycloalkenyl radical.

34. The photoprotective composition as defined by Claim 33, the compound of formula (I') being 1,1-dicarboxy(2,2'-diphenyl)butadiene having the structure:



35. The photoprotective composition as defined by Claim 1, said at least one 4,4-diarylbutadiene UV-A-screening agent having the following formula (II):



in which the diene system is of the Z,Z; Z,E; E,Z or E,E configuration or mixture of said configurations and wherein:

$R^1$ ,  $R^2$ ,  $R^3$  and  $n$  have the meanings indicated in the formula (I);

$Y'$  is a group -O- or -NR<sup>9</sup>-;

$R^9$  is hydrogen, a linear or branched C<sub>1</sub>-C<sub>20</sub> alkyl radical, a C<sub>2</sub>-C<sub>10</sub> alkenyl radical, a C<sub>3</sub>-C<sub>10</sub> cycloalkyl radical, a C<sub>7</sub>-C<sub>10</sub> bicycloalkyl radical, a C<sub>3</sub>-C<sub>10</sub> cycloalkenyl radical, a C<sub>7</sub>-C<sub>10</sub> bicycloalkenyl radical, an aryl radical, a heteroaryl radical;

$X'$  is a residue of a linear or branched, aliphatic or cycloaliphatic C<sub>2</sub>-C<sub>20</sub> polyol comprising from 2 to 10 hydroxyl groups and having the valency  $q$ ; with the proviso that the carbon chain of said residue may be interrupted by one or more sulfur or oxygen atoms, one or more imine groups, one or more C<sub>1</sub>-C<sub>4</sub> alkylimino groups; and

$q$  ranges from 2 to 10.

36. The photoprotective composition as defined by Claim 35, wherein formula (II):

$R^1$  and  $R^2$ , which may be identical or different, are each hydrogen, a  $C_1$ - $C_{12}$  alkyl radical; a  $C_1$ - $C_8$  alkoxy radical, a water-solubilizing substituent selected from among a carboxylate group, a sulfonate group or an ammonium residue;

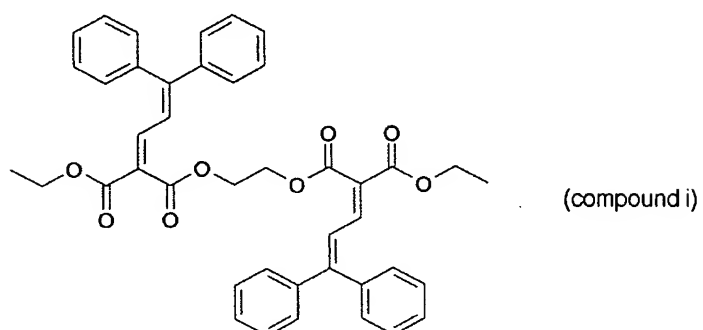
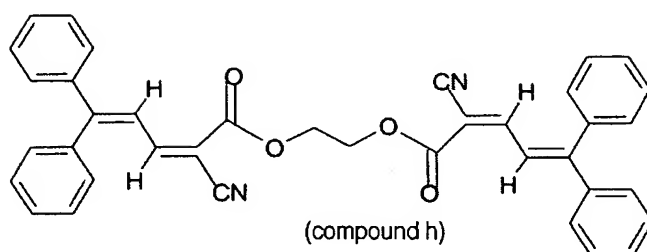
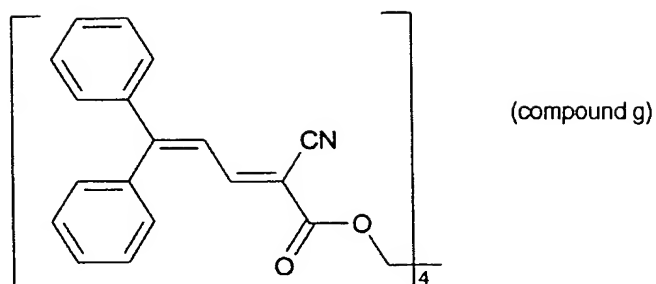
$R^3$  is a group  $COOR^5$ ,  $CONR^5R^6$ , CN, a  $C_3$ - $C_{10}$  cycloalkyl radical, a  $C_7$ - $C_{10}$  bicycloalkyl radical;

$R^5$  and  $R^6$ , which may be identical or different, are each a linear or branched  $C_1$ - $C_{20}$  alkyl radical, a  $C_3$ - $C_{10}$  cycloalkyl radical, a  $C_7$ - $C_{10}$  bicycloalkyl radical, optionally substituted naphthyl or phenyl; and

$X'$  is a  $C_2$ - $C_{20}$  polyol residue comprising from 2 to 6 hydroxyl groups.

37. The photoprotective composition as defined by Claim 36, wherein formula (II),  $X'$  is an ethanol or pentaerythritol residue.

38. The photoprotective composition as defined by Claim 37, said compound of formula (II) being selected from among the following compounds:



39. The photoprotective composition as defined by Claim 1, said at least one 4,4-diarylbutadiene compound constituting from 0.1 % to 20% by weight relative to the total weight of the emulsion.

40. The photoprotective composition as defined by Claim 1, further comprising at least one additional organic or inorganic sunscreens agent active in the UV-A and/or UV-B regions, water-soluble, fat-soluble or insoluble in the usual cosmetic solvents.

41. The photoprotective composition as defined by Claim 40, comprising at least one additional organic screening agent selected from among the anthranilates; cinnamic derivatives; dibenzoylmethane derivatives; salicylic derivatives, camphor derivatives; triazine derivatives; benzophenone derivatives;  $\beta,\beta'$ -diphenyl acrylate derivatives; benzotriazole derivatives; benzalmalonate derivatives; benzimidazole derivatives; imidazolines; bis-benzoazolyl derivatives; p-aminobenzoic acid (PABA) derivatives; benzoxazole derivatives; methylenebis(hydroxyphenylbenzotriazole) derivatives; screening polymers and screening silicones; dimers derived from  $\alpha$ -alkylstyrene and mixtures thereof.

42. The photoprotective composition as defined by Claim 41, said at least one additional organic screening agent comprising:

Ethylhexyl Salicylate,

Ethylhexyl Methoxycinnamate,

Octocrylene,

Butyl Methoxydibenzoylmethane,

Phenylbenzimidazole Sulfonic Acid,

Benzophenone-3,

Benzophenone-4,

Benzophenone-5,

n-Hexyl 2-(4-diethylamino-2-hydroxybenzoyl)benzoate,

4-Methylbenzylidene camphor,

Terephthalylidene Dicamphor Sulfonic acid,

Disodium Phenyl Dibenzimidazole Tetra-sulfonate,

2,4,6-Tris(4'-diisobutyl aminobenzalmalonate)-s-triazine,

Anisotriazine,

Ethylhexyl triazone,

Diethylhexyl Butamido Triazone,  
Methylene bis-Benzotriazolyl Tetramethylbutylphenol,  
Drometrizole Trisiloxane,  
Polysilicone 15,  
2,4-Bis-[5-1-(dimethylpropyl)benzoxazol-2-yl-(4-phenyl)imino]-6-(2-ethylhexyl)imino-1,3,5-triazine,  
and mixtures thereof.

43. The photoprotective composition as defined by Claim 40, comprising at least one additional inorganic screening agent selected from among pigments or nanopigments of metal oxides, whether coated or uncoated.

44. The photoprotective composition as defined by Claim 43, said at least one additional inorganic screening agent comprising nanopigments of titanium oxide, which is amorphous or crystallized, in rutile and/or anatase form, iron oxide, zinc oxide, zirconium oxide or cerium oxide.

45. The photoprotective composition as defined by Claim 1, further comprising at least one agent for artificial bronzing and/or tanning of the skin.

46. The photoprotective composition as defined by Claim 1, further comprising at least one cosmetic adjuvant selected from among organic solvents, ionic or nonionic thickeners, demulcents, humectants, opacifying agents, stabilizers, emollients, silicones, insect repellents, perfumes, preservatives, surfactants, fillers, active agents, pigments, polymers, propellants, alkalizing or acidifying agents or any other ingredient commonly employed in the cosmetic and/or dermatological field.

47. The photoprotective composition as defined by Claim 1, formulated as a dispersion of the lotion or serum type, an oil-in-water or water-in-oil emulsion, a multiple emulsion, a microemulsion, a vesicular dispersion of the ionic and/or nonionic type or a wax/aqueous phase dispersion.

48. The photoprotective composition as defined by Claim 1, formulated as an oil-in-water or water-in-oil emulsion containing at most 1 % by weight of emulsifying surfactant relative to the total weight of the composition.

49. A method for the photoprotection of the skin, lips and/or hair against the damaging effects of UV-radiation, comprising topically applying thereon, a thus effective amount of a photoprotective composition comprising at least one aqueous phase, at least one oily phase, at least one partially or completely neutralized, crosslinked or non-crosslinked water-soluble or water-dispersible acrylamido-2-methylpropanesulfonic acid (AMPS) polymer and at least one UV radiation-screening system, said at least one screening system comprising at least one 4,4-diarylbutadiene UV-A-screening agent.